COs, POs and PSOs mapping examples

Programme Specific Outcomes (PSOs)

PSO1: Design and development of applications on wide range of platforms using various tools and technologies to cater the needs of the society.
PSO2: Ability to pursue higher education and research in the emerging areas of Computer Science**.**

Programme Outcomes (POs)
The graduates of Computer Science and Engineering will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CO's and its mapping

19HS103	ENGINEERING MATHEMATICS I © LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS
CO1	Determine rank, eigenvalues and eigenvectors of a matrix and solution of a system of linear equations.
CO2	Finding inverse of a matrix and powers of a matrix
CO3	Solving differential equations using analytical methods.
CO4	Solving differential equations using numerical methods.
CO5	Use software tools to obtain and verify the solutions.

19HS103	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5					3									
Average	**3**	**3**			**3**									

19HS113	**ENGINEERING PHYSICS (A)**
CO1	Compute the crystal geometry in terms of crystal planes and defects.
CO2	Apply the principles of quantum mechanics to learn the dynamics of free electrons in metal.
CO3	Compute carrier concentration in semiconductors and to understand carrier transport mechanism in semiconductors.
CO4	Evaluate electron dynamics in the presence of electric and magnetic fields.
CO5	Recognise the importance of photonic devices relevant to engineering domains.

19HS113	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2		3												
CO3				3										
CO4		3												
CO5			3											
Average	3	3	3	3										

19EE101	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**
CO1	Analyse the resistive circuits with independent sources and find its solution.
CO2	Solve the AC (single and three phase) and DC circuits using different methods.
CO3	Familiarize the concepts of electromagnetism and it's applications.
CO4	Explain the types of electrical equipment, machines and its applications.
CO5	Acquire the knowledge about the characteristics and working principles of semiconductor diodes, transistor.

19EE101	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3											
CO2	3	3	3											

CO3	3	3											
CO4	3	3											
CO5	3	3											
Average	3	3	3										

19ME104	**ENGINEERING GRAPHICS AND DESIGN**
CO1	Communicate the technical ideas in the form of drawings.
CO2	Apply the drawing skills in representing various geometrical features.
CO3	Develop orthographic projections and isometric views of various objects.
CO4	Estimate the lateral surface area of regular geometrical solids.
CO5	Sketch simple objects and their pictorial views using AutoCAD.

19ME104	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3	3												
CO3			3											
CO4				3										
CO5					3									
Average	3	3	3	3	3									

19CS103	**PROGRAMMING FOR PROBLEM SOLVING - I**
CO1	Understanding of how to write simple, but complete, C programs
CO2	Identification of suitable data type for operands and design of expressions having right precedence.
CO3	Application of decision making and iterative features of C Programming language effectively.
CO4	Selection of problem specific data structures and suitable accessing methods.
CO5	Design and development of non- recursive and recursive functions and their usage to build large modular programs.
CO6	Development of C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.

19CS103	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1			3											
CO2		3											3	
CO3	3												3	
CO4		3												
CO5			3										3	
CO6			3										3	
Average	3	3	3										3	

19CS104	**BASICS OF COMPUTERS AND INTERNET**
CO1	Demonstrate the disassembling and assembling of a personal computer system.
CO2	Install the operating system and other software required in a personal computer system.
CO3	Analyze and visualize the data using various operations in Excel.
CO4	Identify the various threats to users and data.

19CS104	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													

CO2	3	3											
CO3			3										
CO4				3								3	
Average	3	3	3	3								3	

19HS109 ENGINEERING MATHEMATICS II (c) CALCULUS & NUMERICAL METHODS

CO1	Demonstrate the technique of numerical methods to the compute integrals.
CO2	Illustrate the methods of interpolation to find functional values.
CO3	Apply the concepts of partial differentiation in Engineering problems.
CO4	Illustrate the concepts of gradient, divergence and curl of a given function.
CO5	Use software tools to obtain and verify the solutions.

19HS109	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3												
CO3	3	3												3
CO4	3	3												
CO5					3									
Average	3	3			3									3

19CS106	**DISCRETE MATHEMATICAL STRUCTURES**
CO1	Apply propositional logic, predicate logic and Boolean functions to express the mathematical properties.
CO2	Analyze the basic mathematical objects such as sets and relations to verify the mathematical properties.
CO3	Identify the solutions for various problems using recurrence relations.
CO4	Design and Develop solutions for various combinatorial and Graph based problems.

19CS106	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3	3												
CO3			3											
CO4			3	3										
Average	3	3	3	3										

19HS117	**ENGINEERING CHEMISTRY (A)**
CO1	Apply the molecular orbital theory for various types of chemical compounds.
CO2	Analyze the quality of the water and design a suitable water purification mechanism.
CO3	Apply the principle of electrochemistry for designing various batteries and fuel cells.
CO4	Apply the electromagnetic radiation to the spectroscopic methods for the analysis of engineering materials.
CO5	Evaluate the concept of “Nanomaterials” to the applications of electronic engineering.

19HS117	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3	3											
CO3		3	3	3										
CO4			3	3	3									

CO5		3	3											
Average	3	3	3	3	3									

19CS105	**PROGRAMMING FOR PROBLEM SOLVING - II**
CO1	Design and implementation of string manipulation functions.
CO2	Creation of data structure using dynamic memory and manipulation.
CO3	Creation of text files with different access permissions and manipulations.
CO4	Application of suitable formatting for I/O data.
CO5	Development of C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt

19CS105	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1			3										3	
CO2			3										2	
CO3		3												
CO4	3												3	
CO5			3										3	
Average	3	3	3										2.75	

19HS122	**ENGLISH PROFICIENCY AND COMMUNICATION SKILLS**
CO1	Ability to read and grasp the content and significance of news, articles and reports on a wide range of general topics connected with their interests.
CO2	Apply suitable strategies to achieve comprehension, like listening for main points; checking comprehension by using contextual clues etc.
CO3	Ability to follow lectures or talks on topics within their own field, and well structured presentations outside their field.
CO4	Apply their knowledge of functional English to communicate effectively in real life situations and demonstrate good presentation skills in classroom situations.

19HS122	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1									3	3				
CO2									3	3				
CO3									3	3				
CO4									3	3				
Average									3	3				

19HS124	**CONSTITUTION OF INDIA**
CO1	Analyze the major articles and provisions of Indian constitution.
CO2	Understand the constitution and its role in safeguarding individual rights.
CO3	Understand the functioning of organs of the State in a democracy.
CO4	Understand the relationship between rights and duties of citizens.

19HS124	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1						3		3						
CO2						3		3						
CO3						3		3						
CO4						3		3						
Average						3		3						

19ME103	WORKSHOP
CO1	Identify various tools connected to the carpentry, fitting, tinsmith, black smithy, house wiring and welding.
CO2	Fabricate different models using workshop trades.
CO3	Develop methodology as per specifications of the product.
CO4	Understand various advance machine tools and its components.

19ME103	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												
CO3		3												
CO4	3		3											
Average	3	3	3											

19HS123	TECHNICAL ENGLISH COMMUNICATION
CO1	Understand and interpret a wide range of materials on technology.
CO2	Apply a variety of strategies to achieve comprehension, including listening for main points; checking comprehension using contextual clues etc.
CO3	Apply functional/academic language and grammar to express clearly while speaking and make short presentations on general/technical topics.
CO4	Apply functional/academic language and grammar to write clearly on topics related to technology and writing in the workplace.

19HS123	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									3	3				
CO2									3	3				
CO3									3	3				
CO4									3	3				
Average									3	3				

19HS203	PROBABILITY AND STATISTICS
CO1	Determine values of various descriptive measures.
CO2	Learning the concept of curve fitting process and apply it in correlation and regression.
CO3	Appreciate the use of concept of probability in real life situations.
CO4	Apply various probability distributions and their properties to a given situation.
CO5	Analyse a given hypothesis for acceptance or rejection.

19HS203	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3												
CO2		3												
CO3		3												
CO4		3												3
CO5			3											3
Average		3	3											3

19CS201	OOPs THROUGH JAVA

CO1	Define, understand, differentiate the Object Oriented concepts and Java Programming concepts.
CO2	Apply object oriented concepts on real time scenarios.
CO3	Use Exception handling and multithreading mechanisms to create efficient software applications.
CO4	Utilize modern tools and collection framework to create Java applications to solve real world problems.
CO5	Design and develop GUI based applications using applets and swings for internet and system based applications.

19CS201	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	3
CO2	3												3	3
CO3			3										3	3
CO4					3								3	3
CO5			3										3	3
Average	3		3		3								3	3

19CS202	**DATA STRUCTURES**
CO1	Understand the organization of several ADTs and the manipulation (searching, insertion, deletion, traversing) of data stored in various data structures.
CO2	Apply different data structures to solve a given problem.
CO3	Analyze the efficiency of using different data structures and choose the efficient data structure for solving a given problem.
CO4	Develop new algorithms to solve various problems.

19CS202	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	3
CO2	3												3	3
CO3		3											3	3
CO4			3										3	3
Average	3	3	3										3	3

19CS203	**DATABASE MANAGEMENT SYSTEMS**
CO1	Develop an E-R model for real life applications.
CO2	Design and normalize databases for real time applications.
CO3	Devise queries using Relational Algebra, Relational Calculus and SQL.
CO4	Evaluate and optimize queries
CO5	Express queries using database tools like Oracle, DB2, MYSQL, Mongo DB.

19CS203	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		3								3				3
CO2	3		3											3
CO3	3													3
CO4				3										3
CO5					3					3				3
Average	3	3	3	3	3					3				3

19CS204	**DIGITAL LOGIC DESIGN**

CO1	Understand the basic digital logic fundamentals such as number system, binary codes and complements.
CO2	Apply Boolean algebra rules and karnaugh map method to reduce the Boolean functions.
CO3	Design various types of combinational and sequential circuits and improve the performance by reducing the complexities.
CO4	Analyze and differentiate various types of Programmable Logic Devices.

19CS204	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	
CO2	3												3	
CO3			3											3
CO4		3												
Average	3	3	3										3	3

19HS204	**ENVIRONMENTAL STUDIES**
CO1	Understand the importance of environment and natural resources.
CO2	Gain the concept on protection of biodiversity and maintain healthy environment.
CO3	Analyze the sources of pollutants and their effects on atmosphere.
CO4	Identify the evidence of global warming, ozone depletion and acid rain.
CO5	Develop a basic understanding of prevention, mitigation, preparedness, response and recovery.

19HS204	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1						3	3							
CO2							3	3						
CO3				3				3						
CO4							3							
CO5							3	3						
Average				3		3	3	3						

19PC005	**INTRA-DISCIPLINARY PROJECTS-I**
CO1	Map different courses to gain the knowledge of intra-disciplinary engineering.
CO2	Function effectively as an individual and as a member or leader in diverse teams.
CO3	Comprehend and write effective reports and make effective presentations.

19PC005	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	
CO2									3					
CO3										3			3	
Average	3								3	3			3	

19CS211	**OPERATING SYSTEMS**
CO1	Understand, classify the basic concepts of operating system and Real Time Operating System (RTOS).
CO2	Apply the concepts of process scheduling algorithms and process synchronization techniques to derive the efficiency of resource utilization.
CO3	Analyze the requirements for attempting operating systems principles.
CO4	Design the various memory management schemes for a given scenario.
CO5	Simulate the operating systems principles using simulation tools and programming.

19CS211	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												3	
CO3		3												
CO4			3											
CO5					3									
Average	3	3	3		3								3	

19CS212	FORMAL LANGUAGES AND AUTOMATA THEORY
CO1	Understand abstract models of computing, including deterministic (DFA), non-deterministic (NFA), Push Down Automata(PDA) and Turing (TM) machine models and their power to recognize the languages.
CO2	Apply different finite state machines for a language.
CO3	Analyze, the given language is regular or not regular, Ambiguous unambiguous, Recursive or not recursive, Decidable or not Decidable and Por NP.
CO4	Evaluate the string is recognized by the finite automata.
CO5	Design different automata's for a language.

19CS212	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3		3												
CO4				3										
CO5			3		3									
Average	3	3	3	3	3									

19CS213	DESIGN AND ANALYSIS OF ALGORITHMS
CO1	Understand different algorithmic design strategies like divide and conquer, greedy, dynamic programming, backtracking etc.
CO2	Apply various design algorithms to solve a given problem.
CO3	Analyze the efficiency of a given algorithm using time and space complexity theory.
CO4	Investigate which design strategy is efficient to solve a given problem scenario.
CO5	Synthesize new algorithms for solving given problems based on dynamic programming and backtracking techniques and analyze them.

19CS213	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												3	
CO3		3												
CO4				3										
CO5			3		3								3	
Average	3	3	3	3	3								3	

19CS214	COMPUTER ORGANIZATION AND ARCHITECTURE

CO1	Distinguish computer organization and computer architecture; structure and function of computer components; Understand the instruction execution cycle, Understand 8086 architecture.
CO2	Design and develop different digital circuits required to perform the micro operations.
CO3	Design interface circuits for memory and peripheral, DMA and communication devices. Compare various modes of data transfer.
CO4	Develop solutions using assembly level language.
CO5	Evaluate the performance of processor and memory in terms of speed, size and cost.

19CS214	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		3												
CO2			3											3
CO3			3											3
CO4			3	3										3
CO5		3												
Average		3	3	3										3

19CS215	**WEB TECHNOLOGIES**
CO1	Understand the concepts of HTML, CSS and Javascript.
CO2	Apply Javascript features for form validation and JDBC concepts to perform database operations from web pages.
CO3	Analyse the suitability of Servlet and JSP technologies to build solutions for real-world problems.
CO4	Evaluate the performance of web application developed using JSP, Servlet and PHP.
CO5	Design and develop three-tier web applications using JSP, Servlet. and PHP.

19CS215	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3												3	
CO3		3											3	
CO4				3									3	
CO5			3		3			3	3	3			3	
Average	3	3	3	3	3			3	3	3			3	

19MS304	**PRINCIPLES OF MANAGEMENT & ORGANIZATIONAL BEHAVIOR**
CO1	Differentiate personality traits, job attitudes of people.
CO2	Understand person-organization fit.
CO3	Apply group decision making techniques.
CO4	Analyze the effectives of various communication channels.
CO5	Aware of challenges of OB.

19MS304	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3			3										
CO2	3			3										
CO3	3							3						
CO4		3			3			3						
CO5			3											
Average	3	3	3	3	3			3						

19PC009	**INTRA-DISCIPLINARY PROJECTS-II**

CO1	Map different courses to gain the knowledge of intra-disciplinary Engineering.
CO2	Function effectively as an individual and as a member or leader in diverse teams.
CO3	Comprehend and write effective reports and make effective presentations.

19PC009	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2									3				3	
CO3										3				3
Average	3								3	3			3	3

19CS301	DATA MINING TECHNIQUES
CO1	Investigate various patterns that can be extracted from different types of data.
CO2	Apply various pre-processing techniques and classification algorithms on different domains of data.
CO3	Build decision making systems using data mining algorithms for a given real time data set.
CO4	Construct models using modern tools such as WEKA, R and python etc.

19CS301	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3										3
CO2	3													3
CO3			3											3
CO4					3									3
Average	3		3	3	3									3

19CS302	SOFTWARE ENGINEERING
CO1	Understand the basic concepts of software engineering.
CO2	Compare different process models and identify appropriate process model based on project requirements.
CO3	Build Software Requirement Specification (SRS) document for any software product.
CO4	Design of solution using UML diagrams like use case, sequence diagrams etc.
CO5	Design suitable architectural that meets all non functional requirements.
CO6	Apply different testing techniques to ensure bug free software and measure metrics such as software size and quality of the product.

19CS302	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3										3			
CO2		3		3									3	
CO3			3		3									
CO4			3	3	3								3	
CO5					3								3	
CO6				3	3						3		3	
Average	3	3	3	3	3						3		3	

19CS303	COMPILER DESIGN
CO1	Understand the different phases of compiler with various examples.
CO2	Apply different Parsing and optimization techniques in the design of compiler.
CO3	Analyze the code optimaization techniques..
CO4	Design and implement an algorithm for compiler segments and evaluate the algorithm for optimized code generation.

19CS303	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3												3	
CO3		3												
CO4			3										3	
Average	3	3	3										3	

19CS304	COMPUTER NETWORKS
CO1	Apply the routing algorithms for given network scenario.
CO2	Analyse the best fitting logical addressing requirements from the organization.
CO3	Evaluate the protocols for given network scenario.
CO4	Design client server apps on TCP/IP suite.
CO5	Analysis of different protocol packets using modern toos NS2, NS3, packet analyzer and wireshark etc.

19CS304	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2		3												
CO3				3										
CO4			3							3				3
CO5				3	3					3				
Average	3	3	3	3	3					3				3

19HS205	SOFT SKILLS LABORATORY
CO1	Introspect on individual strengths and weaknesses, and emerge as a balanced personality with improved self-awareness and self-worth for their future.
CO2	Prepare a resume and gain the confidence to communicate effectively.
CO3	Possess the interpersonal skills to conduct himself/herself effectively in everyday professional and social contexts.
CO4	Adopt professionalism into daily activities.
CO5	Observe gender sensitive language and workplace etiquette in his professional life.

19HS205	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1												3		
CO2										3				
CO3								3						
CO4								3						
CO5								3						
Average								3		3		3		

19PC011	INTER DEPARTMENTAL PROJECTS - I
CO1	Map different courses to gain the knowledge of inter-disciplinary Engineering.
CO2	Function effectively as an individual and as a member or leader in diverse teams.
CO3	Comprehend and write effective reports and make effective presentations.

19PC011	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2									3				3	

CO3										3				3
Average	3								3	3			3	3

19CS311	**CRYPTOGRAPHY AND NETWORK SECURITY**
CO1	Apply cryptographic techniques in various security service solutions effectively in everyday professional and social contexts.
CO2	Analyse various network security essentials, classical and modern encryption techniques, the network security model, principles of symmetric and asymmetric cryptosystems, protocols and its usage in network, web and system security.
CO3	Design of cryptographic mechanisms using the algorithms for providing the needed services.
CO4	Investigate various network security and system security scenarios for real time applications.

19CS311	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													3
CO2		3												
CO3			3			3								3
CO4				3		3								3
Average	3	3	3	3		3								3

19CS312	**MOBILE COMPUTING**
CO1	Define, explain and understand the android mobile application designmodels and styles.
CO2	Apply activities, dialog boxes, fragments, intents, views and layouts to android apps.
CO3	Analyze various mobile applications during the design of mobile apps.
CO4	Design and develop mobile apps for given real time scenario using modern tool android studio.
CO5	Analyze various routing algorithms used in mobile/wireless networks.

19CS312	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													3
CO3		3												
CO4					3					3				3
CO5		3												
Average	3	3			3					3				3

19CS313	**ARTIFICIAL INTELLIGENCE**
CO1	Apply AI search Models and Generic Search strategies for problem solving.
CO2	Inspect and analyze Logic for representing Knowledge and Reasoning of AI systems.
CO3	Apply and evaluate the searching strategies to achieve the goalfor a given situation.
CO4	Design different learning algorithms for improving the performance of AI systems.
CO5	Conduct investigation and implement project using AI learning techniques.

19CS313	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													3
CO2		3												
CO3			3											3

CO4				3										3
CO5					3									3
Average	3	3	3	3	3									3

19HS206	**PROFESSIONAL COMMUNICATION LABORATORY**
CO1	Communicate effectively both in their academic as well as professional environment.
CO2	Grasp the register of business language.
CO3	Possess the ability to write business reports and proposals clearly and precisely to succeed in their future.
CO4	Make effective presentations and participate in formal meetings.

19HS206	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1										3				
CO2								3						
CO3												3		
CO4										3				
Average								3		3		3		

19HS301	**HUMAN VALUES, PROFESSIONAL ETHICS & GENDER EQUITY**
CO1	Engage in an informed critical reflection on the nature of professionalism and ethical challenges inherent in engineering profession.
CO2	Apply awareness of professional rights and responsibilities of an engineer to conduct themselves ethically within an organization.
CO3	Apply understanding of safety norms to highlight ethical issues in risky situation.
CO4	Understand the role of professional bodies, and the code of ethics and industrial standards prescribed for engineers.

19HS301	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1						3	3	3	3			3		
CO2						3	3	3	3			3		
CO3						3	3	3	3			3		
CO4						3	3	3	3			3		
Average						3	3	3	3			3		

19PC014	**INTER-DEPARTMENTAL PROJECTS II**
CO1	Map different courses to gain the knowledge of inter-disciplinary Engineering.
CO2	Function effectively as an individual and as a member or leader in diverse teams.
CO3	Comprehend and write effective reports and make effective presentations.

19PC014	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2									3				3	
CO3										3				3
Average	3								3	3			3	3

19CS401	**MACHINE LEARNING**
CO1	Apply a wide variety of learning algorithms such as supervised and unsupervised on different kinds of data.

CO2	Analyze the performance of parametric and non-metric approaches on different kinds of data.
CO3	Evaluation of different learning algorithms and model selection.
CO4	Design/Construct a model to realize the solutions for real-world problems.

19CS401	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		3												3
CO2			3											3
CO3				3										3
CO4					3									3
Average		3	3	3	3									3

19PC015	**SOCIETAL-CENTRIC AND INDUSTRY RELATED PROJECTS**
CO1	Study the problems which are related to the society in their production / occupational activities.
CO2	Work on technology applications which can either solve the problems or make the activities less stenuous.
CO3	Design an implement or process to achieve the second outcome.

19PC015	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		3												3
CO2			3										3	
CO3				3										3
Average		3	3	3									3	3

19CS331	**PYTHON PROGRAMMING**
CO1	Analyze the usage of different data structures for practical and contemporary applications for a given problem.
CO2	Develop functional, reliable and user friendly Python programs for given problem statement and constraints.
CO3	Installing the python environment and related packages that are required for practical and contemporary applications.
CO4	Design programs using the concepts of object oriented programming paradigm.
CO5	Create simple programming solutions to the given problems.

19CS331	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2		3											3	
CO3			3											
CO4				3									3	
CO5					3								3	
Average	3	3	3	3	3								3	

19CS332	**EMBEDDED SYSTEMS**
CO1	Understand the concept of embedded system, microcontroller and Real-time operating system.
CO2	Differentiate various components of microcontroller and their interactions.
CO3	Make use of programming environment in ARM to develop embedded solutions.
CO4	Deployment of embedded software into target system. Graph based problems.

19CS332	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2		3												
CO3			3							3		3		3

CO4			3		3								3
Average	3	3	3		3					3		3		3

19CS333	**OPEN SOURCE WEB TECHNOLOGIES**
CO1	Analyze various opensource and commercial products.
CO2	Design dynamic web pages, Web services using PHP.
CO3	Apply HTML5 tags for web page design.
CO4	Develop web based applications.

19CS333	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		3												
CO2			3											
CO3	3												3	
CO4			3										3	
Average	3	3	3										3	

19CS334	**FUNDAMENTALS OF IMAGE PROCESSING**
CO1	Apply various compression techniques to reduce image size and morphological operations to extract features.
CO2	Analyse images in the frequency domain using various transforms.
CO3	Evaluate the techniques for image enhancement and image restoration.
CO4	Interpret Image compression standards, segmentation and representation techniques.

19CS334	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													3
CO2		3												
CO3				3										3
CO4				3										3
Average	3	3		3										3

19CS335	**R PROGRAMMING**
CO1	Apply different data structures for solving a program.
CO2	Analyze the data by applying both linear and non linear regression techniques.
CO3	Investigate results obtained for a given data set by using different plots.
CO4	Design and develop a program for a given scenario.

19CS335	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	
CO2		3												
CO3				3										
CO4			3		3			3	3	3			3	
Average	3	3	3	3	3			3	3	3			3	

19CS336	**NETWORK PROGRAMMING**
CO1	Identify the various standards of networking models to express the mathematical properties.
CO2	Develop the underlying Inter Process Communication and Remote Login.
CO3	Identify different protocols of each OSI layer.

CO4	Compare the conventional sockets with UDP sockets process.
CO5	Analyse TCP Client and Server process code concepts with I/O Multiplexing and sockets Operations.

19CS336	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												3
CO3			3											
CO4				3										
CO5			3											3
Average	3	3	3	3										3

19CS337	CLOUD COMPUTING
CO1	Analyze the trade-offs among deploying of applications in the cloud and the local infrastructure.
CO2	Evaluate the concepts of various virtualization technologies.
CO3	Deploy applications over commercial cloud computing infrastructures.
CO4	Identify security and privacy issues in cloud computing.

19CS337	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3												
CO2				3										3
CO3					3									3
CO4						3		3						
Average		3		3	3	3		3						3

19CS338	ADVANCED DATA MINING
CO1	Comprehend advanced Data Mining paradigms in semi-super vised learning.
CO2	Analyze the algorithmic constructs in web and sentiment mining.
CO3	Apply the advanced data mining techniques for crucial decision making.
CO4	Investigate the extracted patterns for web usage mining.
CO5	Evaluate the performance of data mining models on various kinds of data.

19CS338	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												
CO3	3													3
CO4				3										3
CO5				3										3
Average	3	3		3										3

19CS431	INTERNET OF THINGS
CO1	Analyze the application areas of IOT.
CO2	Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
CO3	Analyze the building blocks of Internet of Things and characteristics.
CO4	Design and develop IoT applications for a given specific problem.

19CS431	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3												
CO2			3											

CO3		3											
CO4				3								3	
Average		3	3	3								3	

19CS432	**MOBILE AD-HOC NETWORKS**
CO1	summarize the protocols used at the MAC layer and scheduling mechanisms to express the mathematical properties.
CO2	apply proactive and reactive routing algorithms to find optimal paths.
CO3	analyze types of routing protocols used for unicast and multicast routing.
CO4	compare the performance of various routing protocols in adhoc networks.
CO5	develop the network security solution and routing mechanism.

19CS432	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	3													3
CO3		3												
CO4				3										3
CO5			3											3
Average	3	3	3	3										3

19CS433	**BIG DATA & ANALYTICS**
CO1	Understand Big Data and its analytics in the real world.
CO2	Use the Big Data frameworks like Hadoop and NOSQL to efficiently store and process Big Data to generate Analytics.
CO3	Design of Algorithms to solve Data Intensive problems using Map Reduce Paradigm.
CO4	Design and Implementation of Big Data Analytics using Pig and Spark to solve Data Intensive problems and to generate analytics.
CO5	Analyse Big Data using Hive.

19CS433	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2		3												3
CO3			3											3
CO4				3										3
CO5					3									3
Average	3	3	3	3	3									3

19CS434	**DEEP LEARNING**
CO1	Design and implement the basic building blocks used in the Deep Learning based solutions.
CO2	Analyze and tune hyper parameters of a Deep Neural network model
CO3	Usage of tools to implement various deep learning models.
CO4	Application of Deep learning to solve various real-time problems.

19CS434	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3		3											
CO2		3												
CO3					3									3
CO4						3			3	3		3		3

Average	3	3	3		3	3			3	3		3		3

19CS436	PARALLEL PROCESSING
CO1	Design and analyze the parallel algorithms for real world problems and implement them on available parallel computer systems.
CO2	Optimize the performance of a parallel program to suit a particular hardware and software environment.
CO3	Design algorithms suited for Multicore processor systems using OpenCL, OpenMP, Threading techniques.
CO4	Analyze the communication overhead of interconnection networks and modify the algorithms to meet the requirements.
CO5	Understand the issues and design complexity for sorting techniques and graph algorithms using Parallel Processing.

19CS436	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3											
CO2			3											
CO3		3	3		3									3
CO4		3												3
CO5			3											3
Average		3	3		3									3

19CS437	GAME THEORY
CO1	Identify strategic situations and represent them as games.
CO2	Solve simple games using various techniques.
CO3	Analyse economic situtations using game theoretic techniques.
CO4	Recommend and prescribe which strategies to implement.

19CS437	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3											3	
CO3		3											3	
CO4			3	3										
Average	3	3	3	3									3	

19CS438	HIGH PERFORMANCE COMPUTING
CO1	Implement high performance versions of standard single threaded algorithms.
CO2	Demonstrate the architec tural features in the OpenMP hardware accelerators.
CO3	Handle in a multicore, shared memory execution environment processor.
CO4	Design and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.

19CS438	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												
CO2		3	3											
CO3			3											3
CO4		3	3	3	3									3
Average	3	3	3	3	3									3

19CS439	ARTIFICIAL NEURAL NETWORKS
CO1	Understand the differences between networks for supervised and unsupervised learning.
CO2	Apply the linear and nonlinear models for learning the data.
CO3	Analyse the performance of various neural networks on different kinds of data.
CO4	Evaluate the neural networks for classify/ cluster the data to achieve higher performance.
CO5	Design/ Develop different neural networks such as MLP, SOM, Hopfiled net and ART etc.

19CS439	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													3
CO3			3											
CO4				3										3
CO5					3									3
Average	3		3	3	3									3

19CS440	DISTRIBUTED SYSTEMS
CO1	Apply the knowledge of distributed systems techniques, trends and methodologies.
CO2	Learn and apply the concept of network virtualization and remote method invocation.
CO3	Analyze the mechanism of peer to peer systems, DFS and DNS.
CO4	Understand key mechanisms and models for distributed systems including logical, clocks, causality, distributed mutual exclusion, distributed deadlocks.
CO5	Gain experience in learning process and resource management.

19CS440	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2	3													
CO3			3											
CO4				3										3
CO5					3									3
Average	3		3	3	3									3

19CS441	WIRELESS SENSOR NETWORKS
CO1	Apply the different routing protocol with respect to the WSN.
CO2	Analyze the difference between conventional Operating System Vs. Embedded Operating Systems.
CO3	Analyze the problem specific Medium Access Control Protocol.
CO4	Compare and differentiate between the WSN and Ad-hoc Networks.
CO5	Develop the WSN Applications with respect any domain specific requirements.

19CS441	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2		3												
CO3		3												
CO4				3										3
CO5			3			3								3
Average	3	3	3	3		3								3